

$\Upsilon(3S)$ $I^G(J^{PC}) = 0^-(1^- -)$ **$\Upsilon(3S)$ MASS**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10355.2±0.5 OUR AVERAGE	[10.3552 ± 0.0005 GeV OUR 2012 AVERAGE]		
10355.2±0.5	1 ARTAMONOV 00	MD1	$e^+ e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10355.3±0.5	2,3 BARU	86B REDE	$e^+ e^- \rightarrow$ hadrons
1 Reanalysis of BARU 86B using new electron mass (COHEN 87).			
2 Reanalysis of ARTAMONOV 84.			
3 Superseded by ARTAMONOV 00.			

NODE=M048M

NODE=M048M

NEW

NODE=M048M;LINKAGE=AR
 NODE=M048M;LINKAGE=C
 NODE=M048M;LINKAGE=RZ

 $m_{\Upsilon(3S)} - m_{\Upsilon(2S)}$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
331.50±0.02±0.13	LEES	11C BABR	$e^+ e^- \rightarrow \pi^+ \pi^- X$

 $\Upsilon(3S)$ WIDTH

VALUE (keV)	DOCUMENT ID
20.32±1.85 OUR EVALUATION	See the Note on "Width Determinations of the Υ States"

NODE=M048DM2

NODE=M048DM2

NODE=M048W

NODE=M048W
 → UNCHECKED ←

NODE=M048215;NODE=M048

 $\Upsilon(3S)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
$\Gamma_1 \Upsilon(2S)$ anything	(10.6 ± 0.8) %	
$\Gamma_2 \Upsilon(2S) \pi^+ \pi^-$	(2.82 ± 0.18) %	S=1.6
$\Gamma_3 \Upsilon(2S) \pi^0 \pi^0$	(1.85 ± 0.14) %	
$\Gamma_4 \Upsilon(2S) \gamma \gamma$	(5.0 ± 0.7) %	
$\Gamma_5 \Upsilon(2S) \pi^0$	< 5.1 × 10 ⁻⁴	CL=90%
$\Gamma_6 \Upsilon(1S) \pi^+ \pi^-$	(4.37 ± 0.08) %	
$\Gamma_7 \Upsilon(1S) \pi^0 \pi^0$	(2.20 ± 0.13) %	
$\Gamma_8 \Upsilon(1S) \eta$	< 1 × 10 ⁻⁴	CL=90%
$\Gamma_9 \Upsilon(1S) \pi^0$	< 7 × 10 ⁻⁵	CL=90%
$\Gamma_{10} h_b(1P) \pi^0$	< 1.2 × 10 ⁻³	CL=90%
$\Gamma_{11} h_b(1P) \pi^0 \rightarrow \gamma \eta_b(1S) \pi^0$	(4.3 ± 1.4) × 10 ⁻⁴	
$\Gamma_{12} h_b(1P) \pi^+ \pi^-$	< 1.2 × 10 ⁻⁴	CL=90%
$\Gamma_{13} \tau^+ \tau^-$	(2.29 ± 0.30) %	
$\Gamma_{14} \mu^+ \mu^-$	(2.18 ± 0.21) %	S=2.1
$\Gamma_{15} e^+ e^-$	seen	
Γ_{16} hadrons		
$\Gamma_{17} g g g$	(35.7 ± 2.6) %	
$\Gamma_{18} \gamma g g$	(9.7 ± 1.8) × 10 ⁻³	

Radiative decays

$\Gamma_{19} \gamma \chi_{b2}(2P)$	(13.1 ± 1.6) %	S=3.4
$\Gamma_{20} \gamma \chi_{b1}(2P)$	(12.6 ± 1.2) %	S=2.4
$\Gamma_{21} \gamma \chi_{b0}(2P)$	(5.9 ± 0.6) %	S=1.4
$\Gamma_{22} \gamma \chi_{b2}(1P)$	(9.9 ± 1.3) × 10 ⁻³	S=2.0
$\Gamma_{23} \gamma A^0 \rightarrow \gamma$ hadrons	< 8 × 10 ⁻⁵	CL=90%
$\Gamma_{24} \gamma \chi_{b1}(1P)$	(9 ± 5) × 10 ⁻⁴	S=1.9
$\Gamma_{25} \gamma \chi_{b0}(1P)$	(2.7 ± 0.4) × 10 ⁻³	
$\Gamma_{26} \gamma \eta_b(2S)$	< 6.2 × 10 ⁻⁴	CL=90%
$\Gamma_{27} \gamma \eta_b(1S)$	(5.1 ± 0.7) × 10 ⁻⁴	
$\Gamma_{28} \gamma X \rightarrow \gamma + \geq 4$ prongs	[a] < 2.2 × 10 ⁻⁴	CL=95%
$\Gamma_{29} \gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-$	< 5.5 × 10 ⁻⁶	CL=90%
$\Gamma_{30} \gamma a_1^0 \rightarrow \gamma \tau^+ \tau^-$	[b] < 1.6 × 10 ⁻⁴	CL=90%

NODE=M048;CLUMP=B

DESIG=5

DESIG=6

DESIG=7

DESIG=103

DESIG=115

DESIG=104

DESIG=13

DESIG=14

DESIG=15

DESIG=102

DESIG=116

DESIG=108

Lepton Family number (*LF*) violating modes

Γ_{31}	$e^\pm \tau^\mp$	<i>LF</i>	< 4.2	$\times 10^{-6}$	CL=90%
Γ_{32}	$\mu^\pm \tau^\mp$	<i>LF</i>	< 3.1	$\times 10^{-6}$	CL=90%

[a] $1.5 \text{ GeV} < m_X < 5.0 \text{ GeV}$ [b] For $m_{\tau^+ \tau^-}$ in the ranges 4.03–9.52 and 9.61–10.10 GeV. **$\Upsilon(3S) \Gamma(i)\Gamma(e^+ e^-)/\Gamma(\text{total})$** **$\Gamma(\text{hadrons}) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$** **$\Gamma_{16}\Gamma_{15}/\Gamma$**

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.414±0.007 OUR AVERAGE			

$0.413 \pm 0.004 \pm 0.006$	ROSNER	06	CLEO	$10.4 \text{ } e^+ e^- \rightarrow \text{hadrons}$
$0.45 \pm 0.03 \pm 0.03$	⁴ GILES	84B	CLEO	$e^+ e^- \rightarrow \text{hadrons}$

4 Radiative corrections reevaluated by BUCHMUELLER 88 following KURAEV 85.

 $\Gamma(\Upsilon(1S)\pi^+ \pi^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$ **$\Gamma_6\Gamma_{15}/\Gamma$**

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
18.46±0.27±0.77				

5 Using $B(\Upsilon(1S) \rightarrow e^+ e^-) = (2.38 \pm 0.11)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.05)\%$. **$\Upsilon(3S) \text{ PARTIAL WIDTHS}$** **$\Gamma(e^+ e^-)$** **$\Gamma_{15}$**

VALUE (keV)	DOCUMENT ID
0.443±0.008 OUR EVALUATION	

 $\Upsilon(3S) \text{ BRANCHING RATIOS}$ **$\Gamma(\Upsilon(2S)\text{anything})/\Gamma_{\text{total}}$** **$\Gamma_1/\Gamma$**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.106 ± 0.008 OUR AVERAGE				

0.1023 ± 0.0105	4625	6,7,8 BUTLER	94B CLE2	$e^+ e^- \rightarrow \ell^+ \ell^- X$
0.111 ± 0.012	4891	7,8,9 BROCK	91 CLEO	$e^+ e^- \rightarrow \pi^+ \pi^- X, \pi^+ \pi^- \ell^+ \ell^-$

6 Using $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\gamma\gamma) = (0.038 \pm 0.007)\%$, and $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^0\pi^0) = (1/2)B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-)$.7 Using $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.06)\%$. With the assumption of $e\mu$ universality.8 Using $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-) = (18.5 \pm 0.8)\%$.9 Using $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.31 \pm 0.21)\%$, $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\gamma\gamma) \times 2B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (0.188 \pm 0.035)\%$, and $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^0\pi^0) \times 2B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (0.436 \pm 0.056)\%$. With the assumption of $e\mu$ universality. **$\Gamma(\Upsilon(2S)\pi^+ \pi^-)/\Gamma_{\text{total}}$** **$\Gamma_2/\Gamma$**

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.82±0.18 OUR AVERAGE				

Error includes scale factor of 1.6. See the ideogram below.

$3.00 \pm 0.02 \pm 0.14$	543k	LEES	11C BABR	$e^+ e^- \rightarrow \pi^+ \pi^- X$
$2.40 \pm 0.10 \pm 0.26$	800	¹⁰ AUBERT	08BP BABR	$e^+ e^- \rightarrow \gamma \pi^+ \pi^- e^+ e^-$
3.12 ± 0.49	980	^{11,12} BUTLER	94B CLE2	$e^+ e^- \rightarrow \pi^+ \pi^- \ell^+ \ell^-$
2.13 ± 0.38	974	¹³ BROCK	91 CLEO	$e^+ e^- \rightarrow \pi^+ \pi^- X, \pi^+ \pi^- \ell^+ \ell^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$4.82 \pm 0.65 \pm 0.53$	138	¹³ WU	93 CUSB	$\Upsilon(3S) \rightarrow \pi^+ \pi^- \ell^+ \ell^-$
3.1 ± 2.0	5	MAGERAS	82 CUSB	$\Upsilon(3S) \rightarrow \pi^+ \pi^- \ell^+ \ell^-$

10 Using $B(\Upsilon(1S) \rightarrow e^+ e^-) = (2.38 \pm 0.11)\%$, $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.05)\%$, and $\Gamma_{ee}(\Upsilon(3S)) = 0.443 \pm 0.008 \text{ keV}$.

11 From the exclusive mode.

12 Using $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\gamma\gamma) = (0.038 \pm 0.007)\%$, and $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^0\pi^0) = (1/2)B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-)$.13 Using $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.31 \pm 0.21)\%$, $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\gamma\gamma) \times 2B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (0.188 \pm 0.035)\%$, and $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^0\pi^0) \times 2B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (0.436 \pm 0.056)\%$. With the assumption of $e\mu$ universality.

NODE=M048;CLUMP=C

DESIG=111

DESIG=105

LINKAGE=C48

LINKAGE=MRG

NODE=M048218

NODE=M048G2

NODE=M048G2

NODE=M048G2;LINKAGE=R

NODE=M048G01

NODE=M048G01

NODE=M048G01;LINKAGE=AU

NODE=M048220

NODE=M048W2

NODE=M048W2

→ UNCHECKED ←

NODE=M048225

NODE=M048R8

NODE=M048R8

NODE=M048R;LINKAGE=A

NODE=M048R;LINKAGE=B

NODE=M048R;LINKAGE=D

NODE=M048R;LINKAGE=C

NODE=M048R4

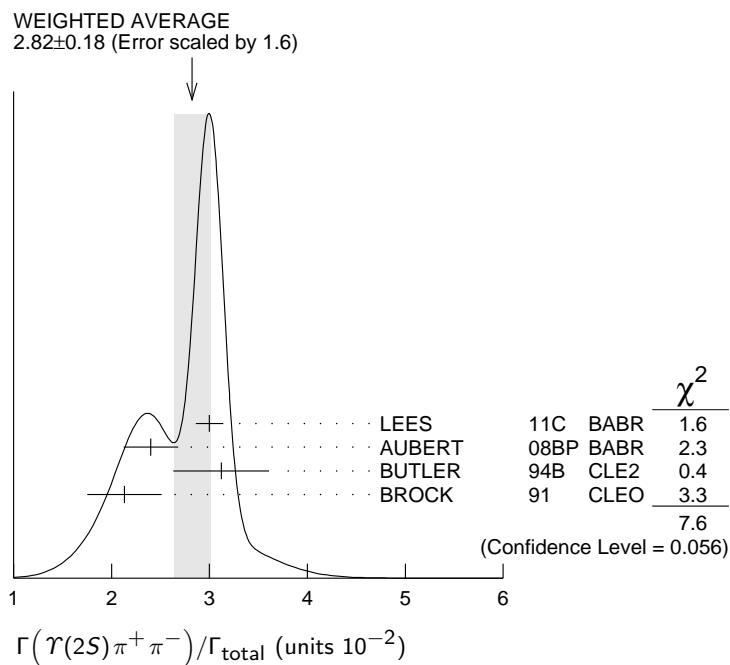
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NODE=M048R4;LINKAGE=AU

NODE=M048R;LINKAGE=M

NODE=M048R4;LINKAGE=A

NODE=M048R4;LINKAGE=C

 **$\Gamma(\gamma(2S)\pi^0\pi^0)/\Gamma_{\text{total}}$**

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.85 ± 0.14 OUR AVERAGE				
1.82±0.09±0.12	4391	14 BHARI	09 CLEO	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
2.16±0.39		15,16 BUTLER	94B CLE2	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
1.7 ± 0.5 ± 0.2	10	17 HEINTZ	92 CSB2	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$

14 Authors assume $B(\gamma(1S) \rightarrow e^+e^-) + B(\gamma(1S) \rightarrow \mu^+\mu^-) = 4.06\%$.

15 $B(\gamma(2S) \rightarrow \mu^+\mu^-) = (1.31 \pm 0.21)\%$ and assuming $e\mu$ universality.

16 From the exclusive mode.

17 $B(\gamma(2S) \rightarrow \mu^+\mu^-) = (1.44 \pm 0.10)\%$ and assuming $e\mu$ universality. Supersedes HEINTZ 91.

 $\Gamma(\gamma(2S)\gamma\gamma)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
0.0502 ± 0.0069			

18 From the exclusive mode.

 $\Gamma(\gamma(2S)\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.51	90	19 HE	08A CLEO	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

19 Authors assume $B(\gamma(2S) \rightarrow e^+e^-) + B(\gamma(1S) \rightarrow \mu^+\mu^-) = 4.06\%$.

 $\Gamma(\gamma(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$

Abbreviation MM in the COMMENT field below stands for missing mass.

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
4.37 ± 0.08 OUR AVERAGE				

4.32±0.07±0.13	90k	20 LEES	11L BABR	$\gamma(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$
4.46±0.01±0.13	190k	21 BHARI	09 CLEO	$e^+e^- \rightarrow \pi^+\pi^-$ MM
4.17±0.06±0.19	6.4K	22 AUBERT	08BP BABR	$10.58 e^+e^- \rightarrow \gamma\pi^+\pi^-\ell^+\ell^-$
4.52±0.35	11830	23 BUTLER	94B CLE2	$e^+e^- \rightarrow \pi^+\pi^- X, \pi^+\pi^-\ell^+\ell^-$
4.46±0.34±0.50	451	23 WU	93 CUSB	$\gamma(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$
4.46±0.30	11221	23 BROCK	91 CLEO	$e^+e^- \rightarrow \pi^+\pi^- X, \pi^+\pi^-\ell^+\ell^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.9 ± 1.0	22	GREEN	82 CLEO	$\gamma(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$
3.9 ± 1.3	26	MAGERAS	82 CUSB	$\gamma(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$

20 Using $B(\gamma(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$ and $B(\gamma(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

21 A weighted average of the inclusive and exclusive results.

22 Using $B(\gamma(2S) \rightarrow e^+e^-) = (1.91 \pm 0.16)\%$, $B(\gamma(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17)\%$, and $\Gamma_{ee}(\gamma(3S)) = 0.443 \pm 0.008$ keV.

23 Using $B(\gamma(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.06)\%$. With the assumption of $e\mu$ universality.

NODE=M048R10
NODE=M048R10

NODE=M048R10;LINKAGE=BH
NODE=M048R;LINKAGE=K
NODE=M048R10;LINKAGE=M
NODE=M048R;LINKAGE=G

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NODE=M048R12;LINKAGE=M

NODE=M048R25
NODE=M048R25

NODE=M048R25;LINKAGE=HE

NODE=M048R3
NODE=M048R3
NODE=M048R3

NODE=M048R3;LINKAGE=LE

NODE=M048R3;LINKAGE=BH
NODE=M048R3;LINKAGE=AU

NODE=M048R3;LINKAGE=B

$\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.577 \pm 0.026 \pm 0.060	800	²⁴ AUBERT	08BP BABR	$e^+e^- \rightarrow \gamma\pi^+\pi^-\ell^+\ell^-$
24 Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$, $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$, $B(\Upsilon(2S) \rightarrow e^+e^-) = (1.91 \pm 0.16)\%$, and $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17)\%$. Not independent of other values reported by AUBERT 08BP.				

 Γ_2/Γ_6

NODE=M048R28
NODE=M048R28

 $\Gamma(\Upsilon(1S)\pi^0\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.20 \pm 0.13 OUR AVERAGE				
2.24 \pm 0.09 \pm 0.11	6584	²⁵ BHARI	09	CLEO $e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
1.99 \pm 0.34	56	²⁶ BUTLER	94B	CLE2 $e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
2.2 \pm 0.4 \pm 0.3	33	²⁷ HEINTZ	92	CSB2 $e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
25 Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.				
26 Using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.06)\%$ and assuming $e\mu$ universality.				
27 Using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.57 \pm 0.07)\%$ and assuming $e\mu$ universality. Supersedes HEINTZ 91.				

 Γ_7/Γ

NODE=M048R11
NODE=M048R11

 $\Gamma(\Upsilon(1S)\pi^0\pi^0)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.501 \pm 0.043	²⁸ BHARI	09	CLEO $e^+e^- \rightarrow \Upsilon(3S)$
28 Not independent of other values reported by BHARI 09.			

 Γ_7/Γ_6

NODE=M048R26
NODE=M048R26

 $\Gamma(\Upsilon(1S)\eta)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.1	90	²⁹ LEES	11L	BABR $\Upsilon(3S) \rightarrow (\pi^+\pi^-)(\gamma\gamma)\ell^+\ell^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.8	90	^{29,30} AUBERT	08BP BABR	$e^+e^- \rightarrow \gamma\pi^+\pi^-\pi^0\ell^+\ell^-$
<0.18	90	³¹ HE	08A	CLEO $e^+e^- \rightarrow \ell^+\ell^-\eta$
<2.2	90	BROCK	91	CLEO $e^+e^- \rightarrow \ell^+\ell^-\eta$
29 Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$, $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.				
30 Using $\Gamma_{ee}(\Upsilon(3S)) = 0.443 \pm 0.008$ keV.				
31 Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.				

 Γ_8/Γ

NODE=M048R9
NODE=M048R9

 $\Gamma(\Upsilon(1S)\eta)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
<0.23	90	³² LEES	11L	BABR $\Upsilon(3S) \rightarrow (\pi^+\pi^-)(\gamma\gamma)\ell^+\ell^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<1.9	90	³³ AUBERT	08BP BABR	$e^+e^- \rightarrow \gamma\pi^+\pi^-(\pi^0)\ell^+\ell^-$
32 Not independent of other values reported by LEES 11L.				
33 Not independent of other values reported by AUBERT 08BP.				

 Γ_8/Γ_6

NODE=M048R27
NODE=M048R27

 $\Gamma(\Upsilon(1S)\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.07	90	³⁴ HE	08A	CLEO $e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
34 Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.				

 Γ_9/Γ

NODE=M048R24
NODE=M048R24

 $\Gamma(h_b(1P)\pi^0)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.2 \times 10 ⁻³	90	³⁵ GE	11	CLEO $\Upsilon(3S) \rightarrow \pi^0$ anything
35 Assuming $M(h_b(1P)) = 9900$ MeV and $\Gamma(h_b(1P)) = 0$ MeV, and allowing $B(h_b(1P) \rightarrow \gamma\eta_b(1S))$ to vary from 0–100%.				

 Γ_{10}/Γ

NODE=M048R03
NODE=M048R03

 $\Gamma(h_b(1P)\pi^0 \rightarrow \gamma\eta_b(1S)\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
4.3 \pm 1.1 \pm 0.9	LEES	11K	BABR $\Upsilon(3S) \rightarrow \eta_b\gamma\pi^0$

 Γ_{11}/Γ

NODE=M048R33
NODE=M048R33

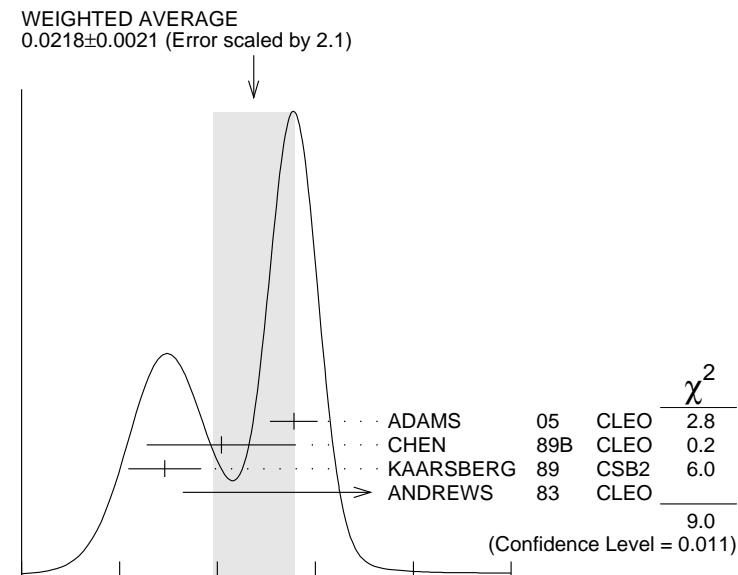
$\Gamma(h_b(1P)\pi^+\pi^-)/\Gamma_{\text{total}}$					Γ_{12}/Γ
VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT	
< 1.2	90	36 LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^-X$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<18		36 BUTLER	94B CLE2	$e^+e^- \rightarrow \pi^+\pi^-X$	
<15		36 BROCK	91 CLEO	$e^+e^- \rightarrow \pi^+\pi^-X$	

36 For $M(h_b(1P)) = 9900$ MeV.

$\Gamma(\tau^+\tau^-)/\Gamma_{\text{total}}$					Γ_{13}/Γ
VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT	
$2.29 \pm 0.21 \pm 0.22$	15k	37 BESSON	07 CLEO	$e^+e^- \rightarrow \gamma(3S) \rightarrow \tau^+\tau^-$	
37 BESSON 07 reports $[\Gamma(\gamma(3S) \rightarrow \tau^+\tau^-)/\Gamma_{\text{total}}] / [B(\gamma(3S) \rightarrow \mu^+\mu^-)] = 1.05 \pm 0.08 \pm 0.05$ which we multiply by our best value $B(\gamma(3S) \rightarrow \mu^+\mu^-) = (2.18 \pm 0.21) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.					

$\Gamma(\tau^+\tau^-)/\Gamma(\mu^+\mu^-)$					Γ_{13}/Γ_{14}
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
$1.05 \pm 0.08 \pm 0.05$	15k	BESSON	07 CLEO	$e^+e^- \rightarrow \gamma(3S)$	

$\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$					Γ_{14}/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
0.0218 ± 0.0021 OUR AVERAGE		Error includes scale factor of 2.1. See the ideogram below.			
0.0239 $\pm 0.0007 \pm 0.0010$ 0.0202 $\pm 0.0019 \pm 0.0033$ 0.0173 $\pm 0.0015 \pm 0.0011$ 0.033 $\pm 0.013 \pm 0.007$					
	81k	ADAMS	05 CLEO	$e^+e^- \rightarrow \mu^+\mu^-$	
		CHEN	89B CLEO	$e^+e^- \rightarrow \mu^+\mu^-$	
		KAARSBERG	89 CSB2	$e^+e^- \rightarrow \mu^+\mu^-$	
	1096	ANDREWS	83 CLEO	$e^+e^- \rightarrow \mu^+\mu^-$	



$\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$

$\Gamma(ggg)/\Gamma_{\text{total}}$					Γ_{17}/Γ
VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT	
35.7 ± 2.6	3M	38 BESSON	06A CLEO	$\gamma(3S) \rightarrow \text{hadrons}$	

38 Calculated using BESSON 06A value of $\Gamma(\gamma gg)/\Gamma(gg) = (2.72 \pm 0.06 \pm 0.32 \pm 0.37)\%$ and the PDG 08 values of $B(\gamma(2S) + \text{anything}) = (10.6 \pm 0.8)\%$, $B(\pi^+\pi^-\gamma(1S)) = (4.40 \pm 0.10)\%$, $B(\pi^0\pi^0\gamma(1S)) = (2.20 \pm 0.13)\%$, $B(\gamma\chi_{b2}(2P)) = (13.1 \pm 1.6)\%$, $B(\gamma\chi_{b1}(2P)) = (12.6 \pm 1.2)\%$, $B(\gamma\chi_{b0}(2P)) = (5.9 \pm 0.6)\%$, $B(\gamma\chi_{b0}(1P)) = (0.30 \pm 0.11)\%$, $B(\mu^+\mu^-) = (2.18 \pm 0.21)\%$, and $R_{\text{hadrons}} = 3.51$. The statistical error is negligible and the systematic error is partially correlated with $\Gamma(\gamma gg)/\Gamma_{\text{total}}$ BESSON 06A value.

NODE=M048R34
NODE=M048R34

NODE=M048R34;LINKAGE=MH

NODE=M048R18
NODE=M048R18

NODE=M048R18;LINKAGE=BE

NODE=M048R19
NODE=M048R19

NODE=M048R1
NODE=M048R1

NODE=M048R30
NODE=M048R30

NODE=M048R30;LINKAGE=BE

$\Gamma(\gamma gg)/\Gamma_{\text{total}}$					Γ_{18}/Γ
VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT	
0.97±0.18	60k	39 BESSON	06A CLEO	$\Gamma(3S) \rightarrow \gamma + \text{hadrons}$	

39 Calculated using BESSON 06A values of $\Gamma(\gamma gg)/\Gamma(ggg) = (2.72 \pm 0.06 \pm 0.32 \pm 0.37)\%$ and $\Gamma(ggg)/\Gamma_{\text{total}}$. The statistical error is negligible and the systematic error is partially correlated with $\Gamma(ggg)/\Gamma_{\text{total}}$ BESSON 06A value.

NODE=M048R31
NODE=M048R31

NODE=M048R31;LINKAGE=BE

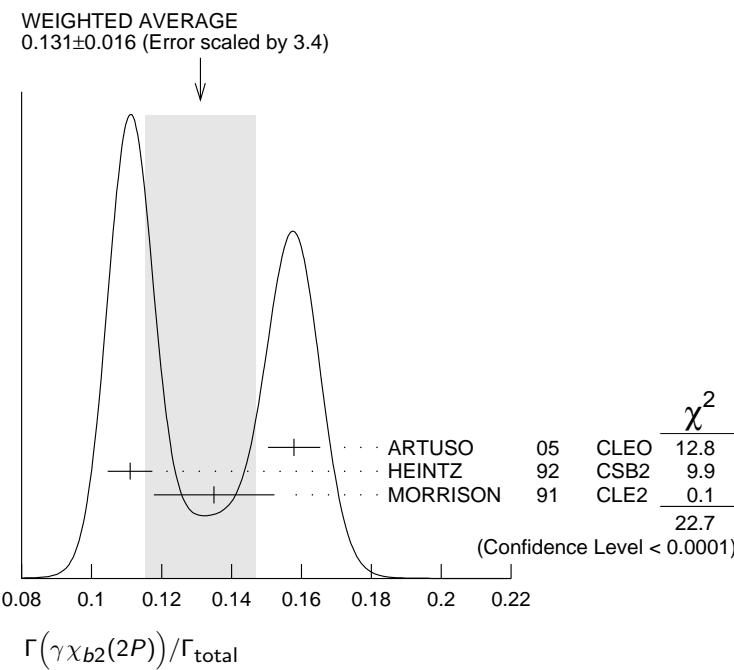
$\Gamma(\gamma gg)/\Gamma(ggg)$					Γ_{18}/Γ_{17}
VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT	
2.72±0.06±0.49	3M	BESSON	06A CLEO	$\Gamma(3S) \rightarrow (\gamma + \text{hadrons})$	

NODE=M048R32
NODE=M048R32

$\Gamma(\gamma \chi b_2(2P))/\Gamma_{\text{total}}$					Γ_{19}/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
0.131 ±0.016 OUR AVERAGE		Error includes scale factor of 3.4. See the ideogram below.			
0.1579±0.0017±0.0073	568k	ARTUSO	05 CLEO	$e^+ e^- \rightarrow \gamma X$	
0.111 ±0.005 ±0.004	10319	40 HEINTZ	92 CSB2	$e^+ e^- \rightarrow \gamma X$	
0.135 ±0.003 ±0.017	30741	MORRISON	91 CLE2	$e^+ e^- \rightarrow \gamma X$	

NODE=M048R5
NODE=M048R5

40 Supersedes NARAIN 91.

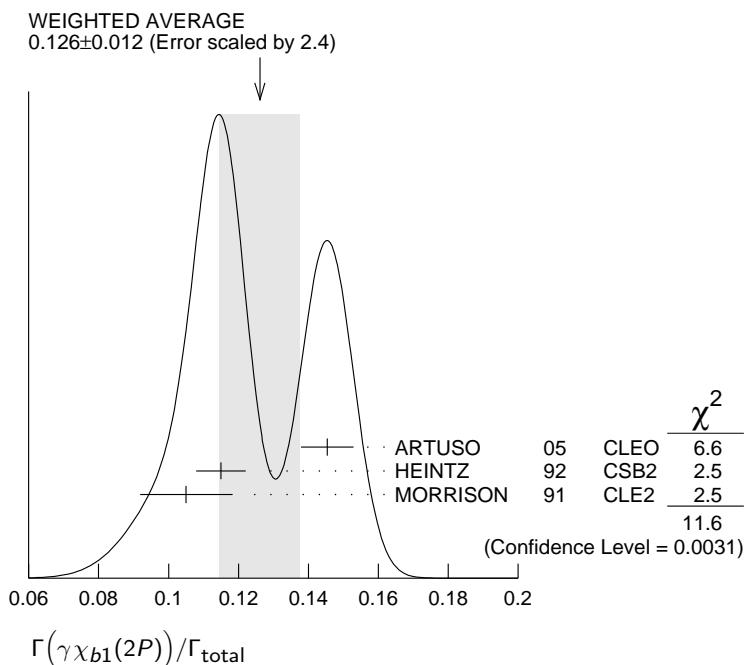


$\Gamma(\gamma \chi b_1(2P))/\Gamma_{\text{total}}$					Γ_{20}/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
0.126 ±0.012 OUR AVERAGE		Error includes scale factor of 2.4. See the ideogram below.			
0.1454±0.0018±0.0073	537k	ARTUSO	05 CLEO	$e^+ e^- \rightarrow \gamma X$	
0.115 ±0.005 ±0.005	11147	41 HEINTZ	92 CSB2	$e^+ e^- \rightarrow \gamma X$	
0.105 ±0.003 ±0.013	25759	MORRISON	91 CLE2	$e^+ e^- \rightarrow \gamma X$	

NODE=M048R6
NODE=M048R6

41 Supersedes NARAIN 91.

NODE=M048R6;LINKAGE=H

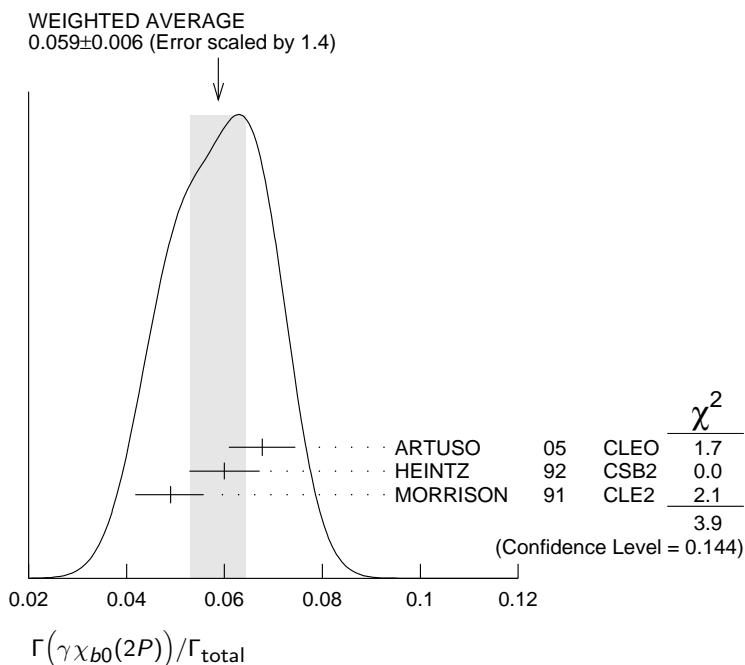


VALUE	EVTS	DOCUMENT ID	TECN	Γ_{21}/Γ
0.059 ± 0.006 OUR AVERAGE		Error includes scale factor of 1.4. See the ideogram below.		
0.0677 ± 0.0020 ± 0.0065	225k	ARTUSO	05	CLEO $e^+e^- \rightarrow \gamma X$
0.060 ± 0.004 ± 0.006	4959	42 HEINTZ	92	CSB2 $e^+e^- \rightarrow \gamma X$
0.049 +0.003 -0.004 ± 0.006	9903	MORRISON	91	CLE2 $e^+e^- \rightarrow \gamma X$

42 Supersedes NARAIN 91.

NODE=M048R7
NODE=M048R7

NODE=M048R7;LINKAGE=H



VALUE (units 10^{-3})	CL %	EVTS	DOCUMENT ID	TECN	Γ_{22}/Γ
9.9±1.3 OUR AVERAGE			Error includes scale factor of 2.0.		
7.5±1.2±0.5	126	43,44 KORNICER	11	CLEO $e^+e^- \rightarrow \gamma\gamma\ell^+\ell^-$	
10.5±0.3 +0.7 -0.6	9.7k	LEES	11J	BABR $\Upsilon(3S) \rightarrow X\gamma$	

NODE=M048R21
NODE=M048R21

• • • We do not use the following data for averages, fits, limits, etc. • • •

<19 seen	90	45 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma + \text{hadrons}$
		46 HEINTZ	92 CSB2	$e^+e^- \rightarrow \gamma\gamma\ell^+\ell^-$

43 Assuming $B(\gamma(1S) \rightarrow \ell^+ \ell^-) = (2.48 \pm 0.05)\%$.

44 KORNICER 11 reports $[\Gamma(\gamma(3S) \rightarrow \gamma\chi_{b2}(1P))/\Gamma_{\text{total}}] \times [B(\chi_{b2}(1P) \rightarrow \gamma\gamma(1S))] = (1.43 \pm 0.162 \pm 0.169) \times 10^{-3}$ which we divide by our best value $B(\chi_{b2}(1P) \rightarrow \gamma\gamma(1S)) = (19.1 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

45 ASNER 08A reports $[\Gamma(\gamma(3S) \rightarrow \gamma\chi_{b2}(1P))/\Gamma_{\text{total}}] / [B(\gamma(2S) \rightarrow \gamma\chi_{b2}(1P))] < 27.1 \times 10^{-2}$ which we multiply by our best value $B(\gamma(2S) \rightarrow \gamma\chi_{b2}(1P)) = 7.15 \times 10^{-2}$.

46 HEINTZ 92, while unable to distinguish between different J states, measures $\sum_J B(\gamma(3S) \rightarrow \gamma\chi_{bJ}) \times B(\chi_{bJ} \rightarrow \gamma\gamma(1S)) = (1.7 \pm 0.4 \pm 0.6) \times 10^{-3}$ for $J = 0,1,2$ using inclusive $\gamma(1S)$ decays and $(1.2^{+0.4}_{-0.3} \pm 0.09) \times 10^{-3}$ for $J = 1,2$ using $\gamma(1S) \rightarrow \ell^+ \ell^-$.

$\Gamma(\gamma\chi_{b1}(1P))/\Gamma_{\text{total}}$

Γ_{24}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.9±0.5 OUR AVERAGE	Error includes scale factor of 1.9.				
1.6±0.5±0.1	50	47,48	KORNICER	11	CLEO $e^+ e^- \rightarrow \gamma\gamma\ell^+\ell^-$
0.5±0.3 ^{+0.2} _{-0.1}		LEES		11J	BABR $\gamma(3S) \rightarrow X\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.7 seen	90	49 ASNER 50 HEINTZ	08A CLEO 92 CSB2	$\gamma(3S) \rightarrow \gamma + \text{hadrons}$ $e^+ e^- \rightarrow \gamma\gamma\ell^+\ell^-$
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47 Assuming $B(\gamma(1S) \rightarrow \ell^+ \ell^-) = (2.48 \pm 0.05)\%$.

48 KORNICER 11 reports $[\Gamma(\gamma(3S) \rightarrow \gamma\chi_{b1}(1P))/\Gamma_{\text{total}}] \times [B(\chi_{b1}(1P) \rightarrow \gamma\gamma(1S))] = (5.38 \pm 1.20 \pm 0.95) \times 10^{-4}$ which we divide by our best value $B(\chi_{b1}(1P) \rightarrow \gamma\gamma(1S)) = (33.9 \pm 2.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

49 ASNER 08A reports $[\Gamma(\gamma(3S) \rightarrow \gamma\chi_{b1}(1P))/\Gamma_{\text{total}}] / [B(\gamma(2S) \rightarrow \gamma\chi_{b1}(1P))] < 2.5 \times 10^{-2}$ which we multiply by our best value $B(\gamma(2S) \rightarrow \gamma\chi_{b1}(1P)) = 6.9 \times 10^{-2}$.

50 HEINTZ 92, while unable to distinguish between different J states, measures $\sum_J B(\gamma(3S) \rightarrow \gamma\chi_{bJ}) \times B(\chi_{bJ} \rightarrow \gamma\gamma(1S)) = (1.7 \pm 0.4 \pm 0.6) \times 10^{-3}$ for $J = 0,1,2$ using inclusive $\gamma(1S)$ decays and $(1.2^{+0.4}_{-0.3} \pm 0.09) \times 10^{-3}$ for $J = 1,2$ using $\gamma(1S) \rightarrow \ell^+ \ell^-$.

$\Gamma(\gamma\chi_{b0}(1P))/\Gamma_{\text{total}}$

Γ_{25}/Γ

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.27±0.04 OUR AVERAGE					
0.27±0.04±0.02	2.3k	LEES	11J	BABR	$\gamma(3S) \rightarrow X\gamma$
0.30±0.04±0.10	8.7k	ARTUSO	05	CLEO	$e^+ e^- \rightarrow \gamma X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.8	90	51 ASNER	08A CLEO	$\gamma(3S) \rightarrow \gamma + \text{hadrons}$
51 ASNER 08A reports $[\Gamma(\gamma(3S) \rightarrow \gamma\chi_{b0}(1P))/\Gamma_{\text{total}}] / [B(\gamma(2S) \rightarrow \gamma\chi_{b0}(1P))] < 21.9 \times 10^{-2}$ which we multiply by our best value $B(\gamma(2S) \rightarrow \gamma\chi_{b0}(1P)) = 3.8 \times 10^{-2}$.				

$\Gamma(\gamma\eta_b(2S))/\Gamma_{\text{total}}$

Γ_{26}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
< 6.2					
< 6.2	90	ARTUSO	05	CLEO	$e^+ e^- \rightarrow \gamma X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<19	90	LEES	11J	BABR	$\gamma(3S) \rightarrow X\gamma$
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$\Gamma(\gamma\eta_b(1S))/\Gamma_{\text{total}}$

Γ_{27}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
5.1±0.7 OUR AVERAGE					
7.1±1.8±1.3	2.3±0.5k	52 BONVICINI	10	CLEO	$\gamma(3S) \rightarrow \gamma X$
4.8±0.5±0.6	19 ± 3k	52 AUBERT	09AQ	BABR	$\gamma(3S) \rightarrow \gamma X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<8.5	90	LEES	11J	BABR	$\gamma(3S) \rightarrow X\gamma$
4.8±0.5±1.2	19 ± 3k	52,53 AUBERT	08V	BABR	$\gamma(3S) \rightarrow \gamma X$
<4.3	90	54 ARTUSO	05	CLEO	$e^+ e^- \rightarrow \gamma X$

52 Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV.

53 Systematic error re-evaluated by AUBERT 09AQ.

54 Superseded by BONVICINI 10.

NODE=M048R21;LINKAGE=KA

NODE=M048R21;LINKAGE=KR

NODE=M048R21;LINKAGE=AS

NODE=M048R21;LINKAGE=HE

NODE=M048R22

NODE=M048R22

NODE=M048R22;LINKAGE=KA

NODE=M048R22;LINKAGE=KR

NODE=M048R22;LINKAGE=AS

NODE=M048R22;LINKAGE=HE

NODE=M048R15

NODE=M048R15

NODE=M048R15;LINKAGE=AS

NODE=M048R16

NODE=M048R16

NODE=M048R17

NODE=M048R17

NODE=M048R17;LINKAGE=BO

NODE=M048R17;LINKAGE=AU

NODE=M048R17;LINKAGE=SU

$\Gamma(\gamma X \rightarrow \gamma + \geq 4 \text{ prongs})/\Gamma_{\text{total}}$ (1.5 GeV < m_X < 5.0 GeV)

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.2	95	ROSNER	07A	CLEO $e^+ e^- \rightarrow \gamma X$

 Γ_{28}/Γ

NODE=M048R20

NODE=M048R20

NODE=M048R20

 $\Gamma(\gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<5.5	90	55 AUBERT	09Z	BABR $e^+ e^- \rightarrow \gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-$

 Γ_{29}/Γ

NODE=M048R04

NODE=M048R04

55 For a narrow scalar or pseudoscalar a_1^0 with mass in the range 212–9300 MeV, excluding J/ψ and $\psi(2S)$. Measured 90% CL limits as a function of $m_{a_1^0}$ range from $0.27\text{--}5.5 \times 10^{-6}$.

 $\Gamma(\gamma a_1^0 \rightarrow \gamma \tau^+ \tau^-)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.6 $\times 10^{-4}$	90	56 AUBERT	09P	BABR $e^+ e^- \rightarrow \gamma a_1^0 \rightarrow \gamma \tau^+ \tau^-$

 Γ_{30}/Γ

NODE=M048R29

NODE=M048R29

56 For a narrow scalar or pseudoscalar a_1^0 with $M(\tau^+ \tau^-)$ in the ranges 4.03–9.52 and 9.61–10.10 GeV. Measured 90% CL limits as a function of $M(\tau^+ \tau^-)$ range from $1.5\text{--}16 \times 10^{-5}$.

 $\Gamma(\gamma A^0 \rightarrow \gamma \text{ hadrons})/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<8 $\times 10^{-5}$	90	57 LEES	11H	BABR $\Upsilon(3S) \rightarrow \gamma \text{ hadrons}$

 Γ_{23}/Γ

NODE=M048R02

NODE=M048R02

NODE=M048R02

57 For a narrow scalar or pseudoscalar A^0 , excluding known resonances, with mass in the range 0.3–7 GeV. Measured 90% CL limits as a function of m_{A^0} range from 1×10^{-6} to 8×10^{-5} .

LEPTON FAMILY NUMBER (LF) VIOLATING MODES $\Gamma(e^\pm \tau^\mp)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<4.2	90	LEES	10B	BABR $e^+ e^- \rightarrow e^\pm \tau^\mp$

 Γ_{31}/Γ

NODE=M048R01

NODE=M048R01

 $\Gamma(\mu^\pm \tau^\mp)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
< 3.1	90	LEES	10B	BABR $e^+ e^- \rightarrow \mu^\pm \tau^\mp$

 Γ_{32}/Γ

NODE=M048R23

NODE=M048R23

• • • We do not use the following data for averages, fits, limits, etc. • • •

<20.3	95	LOVE	08A	CLEO $e^+ e^- \rightarrow \mu^\pm \tau^\mp$
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 $\Upsilon(3S)$ REFERENCES

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KORNICER	11	PR D83 054003	M. Kornicer <i>et al.</i>	(CLEO Collab.)
LEES	11C	PR D84 011104	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	11H	PRL 107 221803	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
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BONVICINI	10	PR D81 031104	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
LEES	10B	PRL 104 151802	J.P. Lees <i>et al.</i>	(BABAR Collab.)
AUBERT	09AQ	PRL 103 161801	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	09P	PRL 103 181801	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	09Z	PRL 103 081803	B. Aubert <i>et al.</i>	(BABAR Collab.)
BHARI	09	PR D79 011103	S.R. Bhari <i>et al.</i>	(CLEO Collab.)
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)
AUBERT	08BP	PR D78 112002	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	08V	PRL 101 071801	B. Aubert <i>et al.</i>	(BABAR Collab.)
HE	08A	PRL 101 192001	Q. He <i>et al.</i>	(CLEO Collab.)
LOVE	08A	PRL 101 201601	W. Love <i>et al.</i>	(CLEO Collab.)
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)
BESSON	07	PRL 98 052002	D. Besson <i>et al.</i>	(CLEO Collab.)
ROSNER	07A	PR D76 117102	J.L. Rosner <i>et al.</i>	(CLEO Collab.)
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ROSNER	06	PRL 96 092003	J.L. Rosner <i>et al.</i>	(CLEO Collab.)
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ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)
ARTAMONOV	00	PL B474 427	A.S. Artamonov <i>et al.</i>	(CLEO Collab.)
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REFID=16775

REFID=53877

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REFID=52592

REFID=52166

REFID=51620

REFID=52079

REFID=51147

REFID=51035

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WU	93	PL B301 307	Q.W. Wu <i>et al.</i>	(CUSB Collab.)	REFID=43313
HEINTZ	92	PR D46 1928	U. Heintz <i>et al.</i>	(CUSB II Collab.)	REFID=43604
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HEINTZ	91	PRL 66 1563	U. Heintz <i>et al.</i>	(CUSB Collab.)	REFID=41580
MORRISON	91	PRL 67 1696	R.J. Morrison <i>et al.</i>	(CLEO Collab.)	REFID=41634
NARAIN	91	PRL 66 3113	M. Narain <i>et al.</i>	(CUSE Collab.)	REFID=41586
CHEN	89B	PR D39 3528	W.Y. Chen <i>et al.</i>	(CLEO Collab.)	REFID=40919
KAARSBERG	89	PRL 62 2077	T.M. Kaarsberg <i>et al.</i>	(CUSB Collab.)	REFID=40733
BUCHMUEL...	88	HE e ⁺ e ⁻ Physics 412	W. Buchmueler, S. Cooper Editors: A. Ali and P. Soeding, World Scientific, Singapore	(HANN, DESY, MIT)	REFID=40034
COHEN	87	RMP 59 1121	E.R. Cohen, B.N. Taylor	(RISC, NBS)	REFID=11616
BARU	86B	ZPHY C32 622 (erratum)	S.E. Baru <i>et al.</i>	(NOVO)	REFID=22338
KURAEV	85	SJNP 41 466	E.A. Kuraev, V.S. Fadin	(NOVO)	REFID=40033
		Translated from YAF 41 733.			
ARTAMONOV	84	PL 137B 272	A.S. Artamonov <i>et al.</i>	(NOVO)	REFID=22278
GILES	84B	PR D29 1285	R. Giles <i>et al.</i>	(CLEO Collab.)	REFID=22280
ANDREWS	83	PRL 50 807	D.E. Andrews <i>et al.</i>	(CLEO Collab.)	REFID=22273
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MAGERAS	82	PL 118B 453	G. Mageras <i>et al.</i>	(COLU, CORN, LSU+)	REFID=22359